show that in North America and South America the annual pressure prevails in excess, or that the variation is positive, as 1874, 1875, 1883, 1890, 1892, 1897. Others show that the entire Northern Hemisphere is in defect as a whole, as 1876, 1878, 1879, 1885, 1887, 1893. Others show the Northern Hemisphere to be in excess, as 1883, 1896, 1897. Other years are more irregular. I have the impression that there is a westward movement of the defect in pressure, or of the negative residuals; and that there are similar groups separated by intervals of seven or eight years. This subject will require an exhaustive study by meteorologists in the future, and much valuable information will be extracted from it.

If the positive values of the pressure variations be added together for each year, and also the negative values by themselves, the result may be indicated as it is plotted in the curves of fig. 29' The upper curve is for the positive and the lower for the negative summation, but these curves show, since they rise and fall together, that these values do not cancel each other. The curves match fairly well with the prominence curve, and I take it to mean that *some external force is at work to raise and lower the total atmospheric pressure by a small amount from year to year.* It is probable that a more rigorous discussion would eliminate certain distortions of this curve, and show that it synchronizes very closely with the curve of the variations of solar energy. If this proves to be so, it raises some exceedingly interesting questions in cosmical meteorology.

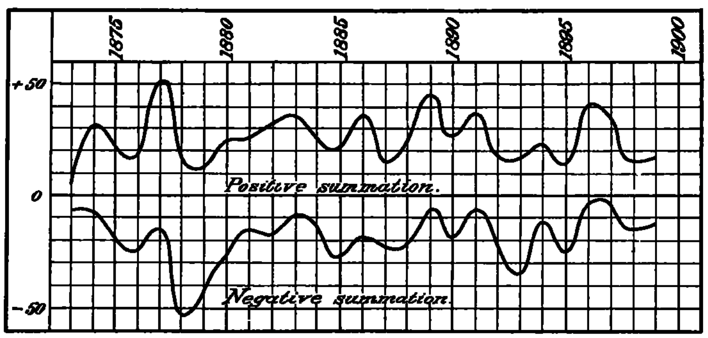

FIG. 29.—Positive and negative pressure variations over the earth as a whole for successive years, on a scale of relative numbers.

It is interesting to compare the results of this series of annual variations, 1873–1899, with those of the series, 1874–1884, studied by H. H. Hildebrandsson,[3] the latter, however, extending the details to the monthly values. The data of the Barometry Report make it possible to do this readily for the United States with little additional labor.

Returning to fig. 28, if we compare the successive pressure groups with the prominence curve, it will be seen that India and southeastern Asia are in very close synchronous agreement. This synchronism extends also to New South Wales, the Indian Ocean, and even to south Africa. In Siberia and Russia the synchronism begins to break a little and seems to be transferred somewhat toward the right, although this may be due in part to defective data. In Europe and in the United States, while the same curve is developed as to the number of the maxima and minima, the synchronism becomes more irregular. In South America, on the other hand, the synchronism is resumed very distinctly, but the *entire curve is reversed as referred to India and the Eastern Hemisphere.* Thus we perceive that around the Indian Ocean the synchronism is clearly developed; it weakens in Europe and North America, and it becomes a distinct reversal in South America. I presume that this remarkable phenomenon is due to the fact that the Pacific-Indian Ocean is quite free from frequent cyclonic disturbances, as is also South America, and that the atmospheric pressure surges back and forth between these two central or southern hemispheres, or else slowly rotates about the entire earth, probably from east to west. In North America and Europe, while the type curve reappears less perfectly, it still exists, and the disturbance may be due to the turbulent cyclonic circulation, which prevails over this region of the earth in marked contrast with the quiescent circulation of the other regions. It is, however, of much importance to have shown that changes in the annual atmospheric pressure of the earth synchronize approximately with the typical output of solar energy.

From this rapid survey of the cosmical meteorological problem, it is obvious that meteorology has large interests in solar and terrestrial magnetism. The annual reports of magnetic observatories are usually published several years after the records are made, hence, if meteorology is to insure any progress in seasonal forecasting, it evidently must possess its own magnetic apparatus, so that the state of the solar-terrestrial field may be known in connection with current meteorological phenomena. It must be conceded that considerable scientific skill will be required to bring this system of cosmical forces into control for the benefit of mankind, but I do not see how it can be doubted that the true pathway of research is already open before us. It is to be hoped that meteorologists generally will take up these cosmical problems, and compute the necessary homogeneous systems, so that it may become possible to advance promptly to practical results.

[3] Quelques recherches sur les centres d'action de l'atmosphère, par H. H. Hildebrandsson, Stockholm, 1897.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

Rainfall data for July, 1902.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	12.82
Kaumana	1,250	13.80
Pepeekeo	100	11.75
Hakalau	200	11.88
Honohina	300	9.03
Puuohua	1,050	13.73
Laupahoehoe	500	9.72
Ookala	400	4.48
HAMAKUA, ne.		
Kukaiau	250	2.69
Paauhau (Mill)	300	1.49
Honokaa (Muir)	425	1.22
Kukuihaele	700	2.22
KOHALA, n.		
Niulii	200	3.44
Kohala (Mission)	521	3.13
Kohala (Sugar Co.)	235	2.42
Hawi Mill	......	3.70
Puuhue Ranch	1,847	1.65
Waimea,	2,720	1.04
KONA, w.		
Holualoa	1,350	11.97
Kealakekua	1,580	13.23
Napoopoo	25	5.16
KAU, se.		
Kahuku Ranch	1,680	3.09
Pahala	850	0.49
PUNA, e.		
Volcano House	4,000	3.79
Olaa, Mountain View	1,700	16.80
MAUI.		
Waiopae Ranch, s	700	0.00
Kaupo (Mokulau), s.	285	5.42
Kipahulu, s	300	8.41
Nahiku, ne	1,600	22.75
Nahiku, ne	850	14.36
Haiku, n	700	2.98
Kula (Erehwon), n	4,500	5.02
Puuomalei, n	1,400	2.40
Kula (Waiakoa), n	2,700	3.49
Paia, n	180	1.32
Haleakala Ranch, n	2,000	1.84
MAUI—*Continued.*	*Feet.*	*Inches.*
Wailuku, ne	200	0.04
OAHU.		
Punahou (W. B.), sw	47	2.87
Kulaokahua, sw	50	1.76
Makiki Reservoir	120	2.99
U. S. Naval Station, sw	6	0.88
Kapiolani Park, sw	10	0.33
Manoa (Woodlawn Dairy), c.	285	10.49
School street (Bishop), sw	50	2.27
Insane Asylum, sw	30	2.32
Kalihi-Uka, sw	260	8.76
Nuuanu (W. W. Hall), sw	50	2.45
Nuuanu (Wyllie street), sw	250	5.15
Nuuanu (Elec. Station), sw	405	4.05
Nuuanu (Luakaha), c	850	12.66
Waimanalo, ne	25	1.68
Maunawili, ne	300	6.13
Ahuimanu, ne	350	6.56
Ewa Plantation, s	60	0.25
Waipahu, s	200	0.00
Moanalua, sw	15	2.02
Rhodes gardens (Manoa)	300	13.05
Nahuina (Castle)	1,150	10.21
Tantalus Heights (Frear)	1,360	10.95
KAUAI.		
Lihue (Grove Farm), e	200	2.38
Lihue (Molokoa), e	300	2.29
Lihue (Kukaua), e	1,000	6.68
Kealia, e	15	1.14
Kilauea, ne	325	4.85
Hanalei, n	10	6.55
Eleele, s	200	0.25
Wahiawa Mountain, s	2,100	12.85
McBryde (Residence)	850	4.15
Lawai	450	4.96
East Lawai	800	3.49
West Lawai	200	1.68
Delayed June reports.		
Waimanalo	......	7.45
Kailua (Hawaii)	......	5.78
Nuuanu (Wyllie street), sw	......	1.87
Wahiawa (Oahu)	......	3.07

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, July, 1902.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.99	76	70	83	75	65.7	67	....	....	3	30.05	29.98	0.01
2	30.01	74	71.5	84	75	67.3	71	ne.	4	7-3	30.07	30.00	0.06
3	29.99	76	71	82	73	69.7	80	ne.	3	7	30.05	29.97	0.14
4	29.96	74	70	84	74	68.3	71	ne.	3	3	30.02	29.96	0.05
5	29.94	75	70	83	74	68.0	75	ne.	4	7-4	30.01	29.94	0.15
6	29.95	70	69	82	73	69.5	79	ne.	3-1	8-4	29.99	29.91	0.07
7	30.00	74	70	84	68	68.7	81	ne.	1-2	4-2	30.04	29.96	0.06
8	29.99	75	68.5	85	72	68.5	73	ne.	3-1	3	30.04	29.99	0.02
9	29.94	76	70.5	84	74	67.3	70	ene.	3-1	3	30.02	29.95	0.04
10	29.96	75	70	85	73	68.3	72	ne.	3-1	5	29.99	29.91	0.01
11	29.97	77	70.5	86	73	68.7	73	se-ne.	2-0	3	30.01	29.95	0.00
12	29.96	77	71	86	74	67.3	67	ene.	3	3	30.03	29.96	0.00
13	29.93	73	69	84	75	68.0	75	ne.	2-3	7-3	30.00	29.94	0.43
14	29.95	76	69.5	82	70	66.0	69	ne.	3-4	6-3	29.98	29.92	0.12
15	29.95	75	69.5	81	72	67.0	72	nne.	3-4	5	30.00	29.95	0.27
16	29.97	76	71	82	74	68.7	77	ne.	3-5	3	30.02	29.94	0.16
17	29.97	75	70	84	73	67.0	69	ne.	3	6-2	30.02	29.94	0.01
18	29.99	75	69.5	85	73	66.0	67	nne.	3	2-0	30.02	29.95	0.12
19	29.99	75	70	84	71	67.5	70	ne.	3-4	4-1	30.02	29.97	0.00
20	30.00	76	70.5	85	74	68.0	72	ne.	3-2	2-5	30.05	29.96	0.05
21	30.02	74	70	85	73	68.0	72	ne.	3-1	2-5	30.05	29.99	0.15
22	29.94	74	69	83	72	67.3	72	ne.	3	4	30.06	29.94	0.20
23	29.89	70	68	82	72	66.0	71	ne.	3-1	3	29.95	29.85	0.02
24	29.90	71	68	84	68	67.3	74	nne.	1-2	1	29.93	29.84	0.00
25	29.95	78	71.5	85	69	67.0	70	se-ne.	1-3	4	29.96	29.86	0.00
26	29.96	76	69	86	76	68.7	72	ne.	3-4	3	30.02	29.94	0.00
27	29.93	71	69	82	76	67.5	75	ne.	3-1	6	30.00	29.93	0.26
28	29.93	75	70	84	69	67.3	73	ne.	3	5	29.98	29.90	0.02
29	29.95	71	70.3	84	74	67.5	73	ne.	3	5	30.00	29.95	0.13
30	29.95	74	69.5	82	71	67.5	76	ne.	3	6	29.99	29.91	0.07
31	29.95	70	69.3	84	71	68.0	76	ne.	3-1	3	29.99	29.93	0.25
Sums	......	......	......	......	......	......	......	....	......	......	......	......	2.87
Means	29.961	74.3	69.8	83.8	72.4	67.7	73	....	2.7	4.0	30.011	29.938	......
Departure	—.024	......	......	......	......	+1.5	+3.5	....	......	0.0	......	......	+1.07

Mean temperature for July, 1902, (6+2+9) ÷ 3 = 77.6; normal is 77.1. Mean pressure for July, 1902, (9+3) ÷ 2 = 29.973; normal is 29.997.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6+9+2+9) ÷ 4. § Beaufort scale.

GENERAL SUMMARY FOR JULY, 1902.

Honolulu.—The water in artesian wells fell during the month from 33.50 to 33.40 feet above mean sea level. July 31, 1901, it stood at 33.00. The average daily mean sea level for the month was 9.86 feet, 10.00 representing the assumed annual mean. Trade wind days, 29 (3 of north-northeast); normal number for this month, 29. Average force of wind (during daylight), Beaufort scale, 2.7. Cloudiness, in tenths of sky, 4.0; normal, in tenths of sky, 4.0.

Approximate percentages of district rainfall as compared with normal: Hilo, 150 per cent; Hamakua, 50; Kohala, 82; Waimea, 30; Kona, 180; Kau, no report arrived; Puna, 120; Maui, very variable from 0 to 300, probable average, 100; Oahu, 150, varying from 100 to 200 and over; Kauai, 120.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 79.4°; mean minimum, 70.6°; Waimea, Hawaii, 2,730 elevation, 77.3° and 65.1°; Volcano House, 4,000 elevation, 71.6° and 54.3°; Kohala, 521 elevation, 79.9° and 68.8°; Waiakoa, Kula, Maui, 2,700 elevation, 84.1° and 61.7°; Ewa Mill, 50 elevation, 85.4° and 70.4°; W. R. Castle, Honolulu, 50 elevation, highest 90°, lowest 69°, mean 77.9°.

Ewa Mill mean dew point, 67.9°; mean relative humidity, 71.6 per cent; Kohala, Dr. B. D. Bond, mean dew point, 68.0°; mean relative humidity, 80.0 per cent.

Heavy surf, 1st to 4th, 15th to 30th. Earthquake, Pepeekeo, Hilo, reports 15th, 12:45 p. m. Thunder and lightning, Hawaii, 16th; lightning to north of Oahu, 24th, evening. Trace of snow still visible on Mauna Kea. "Afterglow" often very marked, but not as bright as in previous month.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Science. New York. Vol. 16.

Elder, E. Waite. Iridescent Clouds. P. 196.

Rotch, A. Lawrence. The International Aeronautical Congress. Pp. 296-301.

Scientific American Supplement. New York. Vol. 54.

Dexter, E. G. The Physiological Effects of Diminished Air Pressure. P. 22291.

Pearson's Magazine. London. Vol. 14.

James, T. E. Freezing Caverns. Pp. 122-124.

Electrical World and Engineer. New York. Vol. 40.

Guarini, Emile. Wireless Telegraphy. Pp. 165-169.

Geographical Journal. London. Vol. 20.

Cornish Vaughan. On Snow-waves and Snow-drifts in Canada, with Notes on the "Snow-Mushrooms" of the Selkirk Mountains. Pp. 137-175.

Nature. London. Vol. 66.

Herschel, A. S. Heights of Sunset After-glows in June, 1902. Pp. 294-296.

Shaw, W. N. Hann's Meteorologie. [Note on Lehrbuch der Meteorologie, by Julius Hann. P. 337-338.

Stewart, Charles. Earthquake of May 28 at the Cape, and coincident Meteorological Effects. Pp. 369-370.

Baddeley, John. Colours between Clouds at Sunset. P. 370.

Hall, W. H. A Triparite Stroke of Lightning. P. 370.

Bryan, G. H. Sunset Effects. P. 390.

Pace, S. Sunset Effects. P. 390.

—— Royal Society Report on the West Indian Eruptions. Pp. 402-406.

Popular Science Monthly. New York. Vol. 61.

Ward, Robert DeC. A Year of Weather and Trade in the United States. Pp. 439-448.

Engineering News. New York. Vol. 48.

—— A study of the Southern River Floods of May and June, 1901. [Abstract of E. W. Myers' report.] Pp. 102-104.

Proceedings of the Royal Society. London. Vol. 70.

Marconi, G. A Note on the Effect of Daylight upon the Propagation of Electromagnetic Impulses over Long Distances. Pp. 344-347.

Brown, Horace T. and Escombe, F. The Influence of Varying Amounts of Carbon Dioxide in the Air on the Photosynthetic Process of Leaves and on the Mode of Growth of Plants. Pp. 397-413.

Farmer, J. Bretland and Chandler, S. E. On the Influence of an Excess of Carbon Dioxide in the Air on the Form and Internal Structure of Plants. Pp. 413-423.

Anderson, Tempest. Preliminary Report on the Recent Eruption of the Soufrière in St. Vincent, and of a Visit to Mont Pelée, in Martinique. P. 423-445.

Cave-Brown-Cave, F. E. and Pearson, Karl. On the Correlation between the Barometric Height at Stations on the Eastern Side of the Atlantic. P. 465-470.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 28.

—— The State of the Ice in the Arctic Seas, 1901. Pp. 157-158.

Wilson-Barker, D. Clouds. Pp. 159-167.

—— Lightning Photographs. Pp. 167-168.

—— Sound Signals and Weather. [Note on article by E. Price Edwards.] P. 173.

—— Rainfall at San Fernando, Spain. P. 211.